REMARKS

Art Rejections

Claims 1-2, 9 and 10 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Abe et al. (JP 2002-050413, machine translation provided). Claims 1-2, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al. (JP 2002-050413, machine translation provided) in view of Murschall (US 20010029274). Claims 1, 5, 8-9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US 6291763) in view of Murschall (US 20010029274). Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US 6291763) in view of Murschall (US 20010029274) as applied to claim 1 above, and further in view of Tamai et al. (US 20020037399).

Applicants respectfully submit that the present invention is neither anticipated by nor obvious over the cited art, alone or in combination, and requests that the Examiner reconsider and withdraw these rejections in view of the following remarks.

The present invention

The present invention is characterized by:

(A) the transparent conductive layer having a surface tension of 40 mN/m or greater,

(B) polyester film that has a light transmittance of no greater than 3% at a wavelength of 370 nm and a light transmittance of 70% or greater at 400 nm, and

(C) polyester film that has absolute value of no greater than 0.8% for the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C.

(1) Feature (A)

Concerning feature (A), the surface tension of a transparent conductive layer without activation of the surface is less than 40 mN/m, as shown in Comparative Example 3 in Table 2 in the present application.

Moreover, feature (A) of the present invention is not the surface of the polyester film but the surface of the transparent conductive layer.

The transparent conductive layer having the surface tension of 40 mN/m or greater can be achieved by a method of activation by plasma treatment or other treatments mentioned at page 10, line 18 - page 11, line 6 of the specification.

(2) Feature (B)

With regard to feature (B) of the present invention, the present invention defines two kinds of light transmittance.

First is the feature of a light transmittance of no greater than 3% at a wavelength of 370 nm, which means the light transmittance at a wavelength of 370 nm needs to be quite low. The background of the first feature is that a metal oxide used in porous semiconductor layer is activated under the ultraviolet wavelength, so the metal oxide reduces the properties of polyester film and solar cells, etc., and then reduces a photogenerating efficiency with time after fabrication of the dye-sensitized solar cell (page 6, line 27 - page 7, line 2 of the specification).

Means to achieve the first feature depend on the kind of polyester. For example, in the case of PEN (polyethylene-2,6-naphthalate), PEN polymer absorbs the UV light by itself; also, containing an ultraviolet absorber is preferable (Example 8 relates to PEN film containing an ultraviolet absorber).

In the case of PET (polyethylene terephthalate), containing an ultraviolet absorber is required (Examples 7 and 9 relate to PET film containing an ultraviolet absorber vs. Reference Example 4, which relates to PET film without an ultraviolet absorber).

The second feature of feature (B) is a light transmittance of 70% or greater at a wavelength of 400 nm, which means the light transmittance at a wavelength of 400 nm needs to be high.

The light transmittance of visible light affects photogeneration, so the light transmittance of the visible light wavelength is required to be 70% or greater. As the Examiner points out, polyester has the property by itself, although when polyester film contains excess ultraviolet absorber, the light transmittance become lower (Reference Example 5 relates to PET film containing excess ultraviolet absorber, which satisfies the first feature but does not satisfy the second feature).

(3) Feature (C)

Feature (C) affects photogenerating performance; more specifically, the absolute value of the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C affects a conhesion between the transparent conductive layer of the laminate film and the porous semiconductor.

Means to achieve this heat shrinkage rates property are not only merely by a heat treatment step or a heat relaxation step, but also by heat treatment performed at specific temperature range (see Table l of the specification).

Cited documents

(a) JP2002-050413 (Abe at al)

Abe at al discloses a laminate film for a dye-sensitized solar cell containing a polyester film (PET) and a transparent conductive layer (ITO).

Meanwhile, the surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 in the present application (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also, Abe at al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Moreover, Abe at al is silent as to the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

Abe at al fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C(feature (C)).

(b) US 2001/0029274 (Murschall at al)

Murschall at al does not disclose a laminate film for a dye-sensitized solar cell containing a polyester film and a transparent conductive layer.

Murschall et al mentions a surface tension of polyester film but is silent as to the surface of the transparent conductive layer.

The description at paragraph [0005] in this document is only that a surface tension 3 is increased when one outer layer whose density is above 1.3 kg/dm^3 is laminated on a base layer with fine vacuoles, with a density of from 0.4 to 1.3 kg/dm^3. Murschall et al only teaches at

paragraph [0005] that the surface tension of the outer layer which has fewer vacuoles than the base layer has increased surface tension.

Also, Murschall et al teaches that the surface tension of the polyester film is improved by some treatments, but Murschall et al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer, and improving the surface tension of the transparent conductive layer.

Murschall at al is also silent as to the light transmittance properties (feature (B)).

Murschall et at fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C (feature (C)).

(c) US6291763 (Nakamura et al)

Nakamura at al discloses a laminate film for a dye-sensitized solar cell containing a polymer film including polyester layer and a transparent conductive layer.

Meanwhile, the surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 of the present application (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also. Nakamura et at is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Nakamura et at disclose only that an electrically conductive substrate is preferably substantially transparent to light, which means that the visible light (wavelength from 400 to 900 nm) transmission is preferably 70% or more (the second feature of the feature (B)).

Meanwhile, Nakamura et at fails to disclose the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

Nakamura et al fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C (feature (C)).

(d) US 2002/0037399 (Tamai et al)

Tamai at al discloses a laminate film containing a polyester film (PET) and a transparent conductive layer (ITO).

The surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 of the present invention (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also, Tamai et al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Tamai et al disclose only that the conductive film is transparent, which means that visible light is transmitted by the layer (the second feature of the feature (B)). Meanwhile, Tamai et at fails to disclose the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

Tamai et al fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C (feature (C)).

Claim Rejections under 103(a)

Concerning feature (A), the transparent conductive layer disclosed by Abe et al and Nakamura et al do not inherently have the specified surface tension (40 mN/m or greater), as described in Comparative Example 3 in the present application.

The Examiner asserts that it would have been obvious to a person of ordinary skill in the art to modify the surface tension to 40 mN/m or greater as evidenced by Murschall at al.

Although Murschall et al teaches that the surface tension of the polyester film is improved by some treatments, Murschall at al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer, and improving the surface tension of the transparent conductive layer.

Therefore, Applicants believe it would not have been obvious to a person of ordinary skill in the art to modify the surface tension of the transparent conductive layer to 40 mN/m or greater because none of Abe, Nakamura and Murschall disclose improving the surface tension of the transparent conductive layer and the problem of improving adhesion between the transparent conductive layer and the porous semiconductor layer for the purpose of improving photogenerating efficiency.

When the laminated film satisfies this property, the photogenerating efficiency is improved (see Table 2, for example).

With regard to the feature (B) of the present invention, Abe and Nakamura disclose the second feature of the light transmittance at 400 nm; however, Abe and Nakamura fail to disclose the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

When the laminated film satisfies this property, the photogenerating efficiency with time after fabrication of the dye-sensitized solar cell is improved (Example 9 shows photogenerating efficiency of 2.1% at an initial stage, and 2.0% after a weather resistance test (page 39, lines 3-11), for example).

Accordingly, Applicants submit that that the present invention novel and unobvious over the cited references alone and in combination, and thus withdrawal of these rejections is respectfully requested.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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